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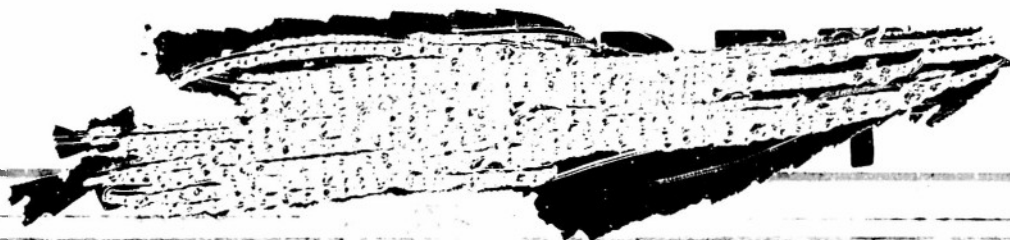
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ARMY FIELD FORCES

REPORT of

Board No. 4 OCAFF Project No. TF-3153

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ELECTRONIC COUNTERMEASURES AGAINST IFF MARK
X AN/TPX-19(), 20(), 21(), 22(), 23()

28 SEP 1954

SPECIAL HANDLING REQUIRED:
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H. F. Williams, Col.

TABLE OF CONTENTS ATTACHED AS A FOLD-OUT TO BACK COVER

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OFFICE, CHIEF OF ARMY FIELD FORCES
Fort Monroe, Virginia

ATDEV-5 113.4, 28(S)(17 Nov 54)

17 November 1954

SUBJECT: Supplemental Report of Test, Project Nr TF-3153, Electronic Countermeasures Against IFF Mark X AN/TPX-19(), 20(), 21(), 22(), 23()

TO: Assistant Chief of Staff, G3
Department of the Army
Washington 25, DC
ATTN: Org, RD Br, O&T Div

1. Reference is made to Item Nr 3015, Signal Corps Technical Committee Meeting Nr 49OCS, which classified Interrogator Sets AN/TPX-19(), 20(), 21(), 22(), 23() as standard.

2. Inclosed is a copy of Board Nr 4, OCAFF, Supplemental Report of Test, Project Nr TF-3153, 28 September 1954. subject: "Electronic Countermeasures Against IFF Mark X AN/TPX-19(), 20(), 21(), 22(), 23()," for information.

3. Efforts by Board Nr 4, OCAFF, to obtain information on the electronic countermeasures vulnerability of the IFF Mark X resulted in inconclusive results. The test was conducted, using the standard Air Force noise jammer AN/APT-5 against a typical IFF Mark X equipment.

4. In view of the limited scope of the test, this Office is proposing no formal action, pending results of future tests to be scheduled at a 18-20 November conference at Board Nr 4, OCAFF.

SPECIAL HANDLING REQUIRED:

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BY AUTHORITY OF Frank F. Williams

DATE 17 November 1954 Colonel

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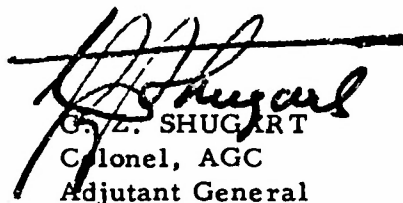
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5. This Office has not received a directive governing release of countermeasures information to foreign nationals. Copies of reports normally distributed to Canadian and British Armies are forwarded for appropriate disposition.

FOR THE CHIEF OF ARMY FIELD FORCES:


G. Z. SHUGART
Colonel, AGC
Adjutant General

1 Incl
AFF Rept of Bd Nr 4,
OCAFF, Proj Nr
TF-3153, 28 Sep 54,
subj: "Electronic
Countermeasures
Against IFF Mark X
AN/TPX-19(), 20(),
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BOARD NUMBER 4 (8576 AAU)
OFFICE, CHIEF OF ARMY FIELD FORCES
FORT BLISS, TEXAS

/ac

SUPPLEMENTAL REPORT OF TEST
PROJECT NR TF-3153
ELECTRONIC COUNTERMEASURES AGAINST IFF MARK X
AN/TPX-19(), 20(), 21(), 22(), 23()

28 SEP 1954

1. Authority. (Confidential)

a. Directive. Letter, ATDEV-5 413.4(C), OCAFF, 19 Jan 53, subject: "Service Test of Interrogator Sets AN/TPX-19(), 20(), 22(), 23()."

b. Purpose. Equipment is to be tested to determine its suitability and adequacy for Army Field Forces use. Basis of issue of this equipment is to be recommended. While this report will discuss theoretical methods of countermeasuring IFF Mark X, it is specifically a report on the jamming of the IFF receiver. This is one of the countermeasures which can most readily be performed with existing equipment.

2. References. (Confidential).

a. Item 3015, SCTC Meeting Nr 490 cs, 6 Oct 52, which classified Interrogator Sets AN/TPX-19(), 20(), 21(), 22() as standard.

b. AFF Board Nr 4 Report of Project TF-253, Partial Report of Test of IFF Mark X AN/TPX-19 approved by OCAFF 1 Sept 1953.

c. Board Nr 4, OCAFF, Second Partial Report of Test, Project TF-3153, Report of Test of IFF Mark X AN/TPX-20, forwarded to OCAFF 28 Jan 54.

d. Board Nr 4, OCAFF, Third Partial Report of Test, Project TF-3153, Report of Test of IFF Mark X AN/TPX-23, (Canadian Model) forwarded to OCAFF 25 Feb 1953.

e. Board Nr 4, OCAFF, Fourth Partial R/T, Project TF-3153, R/T of IFF Mark X, AN/TPX-22 forwarded to OCAFF, April 1954.

f. Board Nr 4, OCAFF, Fifth Partial R/T, Project TF, 3153, Report of Test of AN/TPX-21 presently being coordinated with other agencies.

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g. Board Nr 4, OCAFF, Sixth Partial R/T, Project TF-3153, Report of AN/TPX-23 (American Model), presently being prepared.

h. Report, Air Proving Ground Command, Project APG/SAB/64 A, subject: "Operational Suitability Test of the Selective Identification Feature for the IFF Mark X System," dated 16 Oct 52.

3. Description of Material. (Confidential)

a. The AN/TPX-19 through 23 are IFF Mark X interrogator-responders designed to interrogate the AN/APX-6 airborne transponder. The AN/TPX-19, 20, 21, 22, and 23 are to be used in conjunction with present AA radars, the AN/TPS-1D, the AAFCS M33, the T9 radar (Skysweeper), the SCR 584, and the AN/MPS-501 respectively.

b. Since each of these IFF sets must interrogate and receive responses from the same type equipment, the AN/APX-6, all must have the same transmitting and receiving frequencies. In addition they are similar in circuitry and have many parts completely interchangeable. IFF Mark X equipment for Air Force ground radars, principally the AN/CPS-6 and AN/FPS-3, is of necessity quite similar to Army IFF Mark X equipment.

c. Future plans call for installation of coding devices on all of this equipment. The basic coding device is known as the Selective Identification Feature (SIF). Reference 2h. The SIF equipment, when available, will be connected to the present equipment without major modification being required. SIF is anticipated for test by Army Field Forces Board Nr 4 in 1954.

d. The jammer employed in this test was a standard USAF AN/APT-5 noise jammer with an output varying from 10 to 50 watts maximum.

4. Background. A need exists for the rapid identification of aircraft by all AA units. The IFF Mark III system developed in World War II was considered unsatisfactory due to size, complexity, and ease of compromise by enemy forces. The IFF Mark X equipment has been developed to overcome these deficiencies. The subject interrogator responders, except for the American model AN/TPX-23, have been service tested as reported in references, paragraph 2b through f. This supplemental report covers the attempted jamming of a typical set by the AN/APT-5.

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5. Discussion.

a. (Confidential). Three different frequencies are involved whenever a radar is equipped with IFF Mark X. The first frequency is the basic frequency of the radar, which remains unchanged by the addition of the Mark X equipment. The second frequency is the IFF interrogating frequency (1010-1030 mc). Both the ground IFF transmitter and the airborne transponders' receiver are on this frequency. The interrogation pulses trigger the transponder and it transmits the reply pulse on the third frequency (1090-1110 mc). Both the airborne transponder's transmitter and the ground IFF receiver are on the third frequency. Jamming of this last frequency was tested under this report. However, other forms of countermeasures against IFF Mark X are discussed to show their relation to this test.

b. (Secret) The simplest means of destroying the effectiveness of the IFF Mark X system is for an enemy force to duplicate the transponder, or use captured transponders, and appear as friendly aircraft. The SIF system mentioned in paragraph 3c is being designed with a view to nullifying enemy efforts to thus compromise the system.

c. (Secret) A second means of destroying the effectiveness is to jam the transponder's receiving frequency. If such interference can prevent the transponder from replying, then both friendly and enemy aircraft appear with no reply, and the advantages of the IFF Mark X system are effectively nullified. The best form of jamming to accomplish this effect would be the transmission of a series of interrogation pulses which would trigger the transponder until it becomes saturated and refuses to answer. Although no such jammer is known to be in existence, it is perfectly feasible to make.

d. (Secret) By jamming on the ground IFF equipment's receiving frequency it was contemplated that so much interference could be placed on the scopes of the parent radar that the operator would shut the IFF off in order to operate. This condition would effectively nullify the IFF Mark X system, and has the advantage of using existing type noise jammers. This form of electronic countermeasure was tested under this report. The AN/APT-5 standard Air Force noise jammer was used throughout the test in the jamming aircraft, while the AN/TPS-1D with IFF Mark X AN/TPX-19 was used as typical ground equipment.

6. Summary of Test. (Secret)

a. During the first phase of the test the radar operator took no defense against the jamming aircraft. The jamming

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appeared in exactly the same way conventional jamming does on the scope of the AN/TPS-1D. That is, the "hostile" aircraft initially hid itself in strobe of jamming from a range of about 42 miles (Condition 1). As the aircraft approached the radar the jamming increased in intensity until a complete blanking of the scope appeared (Condition 5) at a range of about 3 miles.

b. During the second phase of the jamming the operator of the ground station eliminated the jamming either by shutting off the IFF for one sweep or by turning down the IFF gain. It was possible to turn the receiver gain down far enough to eliminate the jamming, yet still be strong enough to receive responses from friendly aircraft. This is attributed to the fact that the transponder's power varies from 250 to 1,000 watts, while the jammer power varies from 10 to 50 watts. The hostile aircraft could be readily detected, and by its jamming was immediately identified as hostile.

7. Conclusions. (Secret)

a. Use of the IFF Mark X system in effect opens all radars equipped with the system to jamming on the IFF receiver frequency, regardless of the frequency of the parent radar.

b. Jamming by the AN/APT-5 on the IFF receiver frequency is not an effective countermeasure. By proper use of the IFF gain control the jamming can virtually be eliminated, while friendly responses continue to appear.

c. A much more powerful jammer (250 to 1,000 watts output) than the AN/APT-5 could potentially jam the IFF Mark X system in the same manner, but more effectively. Such a jammer would not present a serious problem to the parent radar's other functions, because the operator can always turn the IFF off and continue to operate in the normal manner.

8. Recommendations. Basis of issue of this type equipment is covered in the individual reports on the equipment, references 2b through g.



A. H. BENDER
Colonel, Arty
President

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